a power supply coupled to the gas manifold;

a vacuum system for controlling pressure within the vacuum chamber;

a controller, including a computer, for controlling the gas distribution system, the power supply and the vacuum system; and

a memory coupled to the controller comprising a computer readable medium having a computer readable program code embodied therein for directing operation of the substrate processing system, the computer readable program code including:

computer readable program code for causing the gas distribution system to introduce a first process gas comprising a mixture of SiH_4 and N_20 into the chamber to deposit a first plasma enhanced CVD layer over the wafer; and

computer readable program code for causing the gas distribution system to introduce a second process gas comprising He into the chamber to control the deposition rate of the first layer.

2. A substrate processing system as in claim 1 wherein the computer readable program code for causing the gas distribution system to introduce the first process gas comprising a mixture of SiH_4 and N_20 into the chamber controls the introduction of the SiH_4 to be between 5 to 300 sccm, and the rate of N_20 to be between 5 to 300 sccm.

3. A substrate processing system as in claim 2 wherein the computer readable program code for causing the gas distribution system to introduce a second process gas comprising He into the chamber controls the chamber pressure at about 1 to 6 torr, the chamber pressure being the pressure inside the chamber.

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4. A substrate processing system as in claim 3 wherein the computer readable program code for causing the gas distribution system to introduce the first process gas comprising a mixture of SiH_4 and N_20 into the chamber controls the introduction of the SiH_4 to be at a volumetric flow rate of between 0.5 to 3 times the volumetric flow rate of N_20.

5. A substrate processing system as in claim 1 further comprising:

computer readable program code for causing the gas distribution system to introduce a third process gas comprising NH_3 into the chamber; and

computer readable program code for causing the gas distribution system to introduce a fourth process gas comprising N_2 into the chamber.

6. A substrate processing system as in claim 5 wherein:

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the computer readable program code for causing the gas distribution system to introduce a third process gas comprising NH_3 into the chamber controls the introduction of the NH_3 to be between a rate of 0 to 300 sccm; and

the computer readable program code for causing the gas distribution system to introduce a fourth process gas comprising N_2 into the chamber controls the introduction of the N_2 to be between a rate of 0 to 4000 sccm.

7. A substrate processing system as in claim 1 further comprising computer readable program code for controlling the gas distribution system to operate for a specified time period.

8. A substrate processing system as in claim 7 wherein the computer readable program code for controlling the gas distribution system to operate for a specified time period comprises computer readable program code for causing the first plasma enhanced CVD layer to be formed to a thickness which is an odd multiple, greater than one, of a wavelength of light to be used in a subsequent process operation on the layer.

9. A substrate processing system as in claim 2 wherein the computer readable program code for causing the gas distribution system to introduce the first process gas comprising a mixture of SiH_4 and N_20 into the chamber controls the introduction of the SiH_4 to be between 15 to 160 sccm, and the rate of N_20 to be between a rate of 15 to 160 sccm.

10. A substrate processing system as in claim 9 further comprising:

computer readable program code for causing the gas distribution system to introduce a third process gas comprising NH_3 into the chamber at a rate of less than 150 sccm; and

computer readable program code for causing the gas distribution system to introduce a fourth process gas comprising N_2 into the chamber at a rate of less than 300 sccm.

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44. A substrate processing system, comprising:

a process chamber;

a substrate support, located within the process chamber, for supporting a substrate;

a power supply;

a gas delivery system for delivering process gases into the process chamber;

a controller configured to control the power supply and the gas delivery system; and

a memory coupled to the controller comprising a computer readable medium having a computer readable program embodied therein for directing operation of the substrate processing

system, the computer readable program including a first set of computer instructions for controlling the gas delivery system to introduce selected deposition gases into the process chamber at deposited gas flow rates, a second set of computer instructions for controlling the gas delivery system to add a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from a plasma enhanced reaction of the selected deposition gases, the desired low deposition rate being lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas, and a third set of computer instructions for controlling the power supply to supply power to the process chamber to produce a plasma enhanced reaction of the deposition gases in the process chamber to deposit a film at the low deposition rate.

45. The substrate processing system of claim 44 wherein the inert gas comprises helium.

46. The substrate processing system of claim 44 wherein the selected deposition gases comprise silane and an oxygen source.

47. The substrate processing system of claim 44 wherein the selected deposition gases comprise silane and nitrous oxide.

48. The substrate processing system of claim 44 wherein the selected deposition gases comprise silane and a nitrogen source.

49. The substrate processing system of claim 44 further comprising a vacuum system for controlling pressure within the process chamber, and wherein the computer-readable program further comprises a fourth set of computer instructions for controlling the vacuum system to maintain a chamber pressure in the range of 1-6 Torr, and wherein the selected deposition gases comprise SiH_4 flowed into the chamber at a rate of 5-300 sccm and N_2O flowed into the chamber at a rate of 5-300 sccm.

50. The substrate processing system of claim 49 further comprising a heater for heating the substrate, and wherein the computer-readable program further comprises a fifth set of computer instructions for controlling the heater to heat the substrate to a temperature in the range of 200-400°C.

51. The substrate processing system of claim 50 wherein the substrate support is spaced from the gas distribution system at a distance in the range of 200-600 mils.

52. The substrate processing system of claim 49 wherein the selected deposition gases further comprise NH_3 flowed into the chamber at a rate of less than 300 sccm, and N_2 flowed into the chamber at a rate of less than 4000 sccm.

53. A substrate processing system, comprising:

a process chamber;

a substrate support, located within the process chamber, for supporting a substrate;

an RF power supply;

a heater;

a gas delivery system for delivering process gases into the process chamber;

a controller configured to control the power supply and the gas delivery system; and

a memory coupled to the controller comprising a computer readable medium having a computer readable program embodied therein for directing operation of the substrate processing system, the computer readable program including a first set of computer instructions for controlling the gas delivery system to flow He into the process chamber at a selected flow rate to provide a chamber pressure in the range of 1-6 Torr, a second set of computer instructions for controlling the RF power supply to supply power of 50-500 Watts to the process chamber, a third set of computer instructions for controlling the heater to heat the substrate to a temperature in the range of 200-400°C, a fourth set of computer instructions for controlling the gas delivery system to flow SiH_4 at a flow rate of 5-300 sccm into the process chamber, and a fifth set of computer instructions to flow N_2O at a flow rate of 5-300 sccm into the process chamber, wherein a ratio of the selected flow rate of He to the combined flow rate of SiH_4 and N_2O is at least 6.25:1 to deposit an antireflective layer on the substrate at a deposition rate which is lower than a deposition rate using the same flow rate of SiH_4 and the same flow rate of N_2O with a lower flow rate of He.

54. A substrate processing system, comprising:

a process chamber;

a substrate support, located within the process chamber, for supporting a substrate;

a power supply;

a gas delivery system for delivering process gases into the process chamber;

a controller configured to control the power supply and the gas delivery system; and

a memory coupled to the controller comprising a computer readable medium having a computer readable program embodied therein for directing operation of the substrate processing

system, the computer readable program including a first set of computer instructions for controlling the gas delivery system to flow selected deposition gases into the process chamber at deposition gas flow rates, a second set of computer instructions for controlling the gas delivery system to add a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from a reaction of the selected deposition gases, the desired low deposition rate being lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas, and a third set of computer instructions for controlling the power supply to supply power to the process chamber to react the deposition gases to deposit a film at the low deposition rate.

55. A substrate processing system comprising:

a process chamber;

a substrate support, located within the process chamber, for supporting a substrate;

a gas delivery system for delivering selected deposition gases into the process chamber at deposition gas flow rates;

means for adding a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from plasma enhanced reaction of the selected deposition gases, the desired low deposition rate being lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas; and

means for depositing a thin film at the low deposition rate from a plasma enhanced reaction of the deposition gases.

56. The system of claim 55 further comprising:

means for maintaining a chamber pressure of the process chamber in the range of 1-6 Torr; and

means for heating the substrate to a temperature in the range of 200-400°C.

57. A substrate processing system comprising:

a processing chamber;

a substrate support, located within the processing chamber, for supporting a substrate;

means for flowing He into the processing chamber at a selected flow rate to provide a chamber pressure in the range of 1-6 Torr;

means for connecting the chamber to an RF power supply to receive 50-500 Watts;

means for heating the substrate to a temperature in the range of 200-400°C;

means for flowing SiH_4 through a gas distribution system at a flow rate of 5-300 sccm; and

means for flowing N_2O through the gas distribution system at a flow rate of 5-300 sccm, wherein a ratio of the selected flow rate of He to the combined flow rate of SiH_4 and N_2O is at least 6.25:1 to deposit an antireflective layer on the substrate at a deposition rate which is lower than a deposition rate using the same flow rate of SiH_4 and the same flow rate of N_2O with a lower flow rate of He.

58. The system of claim 57 further comprising means for introducing NH_3 into the chamber at a rate of 0-300 sccm.

59. The system of claim 58 further comprising means for introducing N_2 into the chamber at a rate of 0-4000 sccm.

60. A substrate processing system comprising:

a substrate processing chamber;

a substrate support, located within the process chamber, for supporting a substrate;

a gas delivery system for delivering process gases into the substrate processing chamber;

means for forming an antireflective layer over a layer on the substrate by flowing selected deposition gases into the substrate processing chamber at deposition gas flow rates and adding a flow of an inert gas to the selected deposition gases to deposit the antireflective layer at a desired deposition rate which is lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas;

means for forming a layer of photoresist on the antireflective layer, the antireflective layer having a thickness and refractive indices such that a first reflection from an interface between the photoresist and the antireflective layer of an exposure light will be an odd number which is at least 3 multiplied by 180° out of phase with a second reflection from an interface between the antireflective layer and the substrate layer of the exposure light; and

means for forming a photoresist pattern by exposing the photoresist layer to the exposure light and developing the exposed photoresist layer.

61. A substrate processing system comprising:

a substrate processing chamber;

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a substrate support, located within the process chamber, for supporting a substrate;

a gas delivery system for delivering process gases into the substrate processing chamber;

means for forming an SiON antireflective layer over a first layer on the substrate by flowing selected deposition gases into the substrate processing chamber at deposition gas flow rates and adding a flow of an inert gas to the selected deposition gases to deposit the SiON antireflective layer at a desired deposition rate which is lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas, said antireflective layer having a refractive index in the range of 1.7-2.9, an absorptive index in the range of 0-1.3, and a thickness in the range of 200-3000 angstroms;

means for forming a layer of photoresist over the antireflective layer; and

means for forming a photoresist pattern by exposing the photoresist layer to an exposure light having a wavelength of 365 nm or less and developing the exposed photoresist layer, wherein a phase shift of an odd multiple of at least 3 multiplied by 180° exists between a first reflection of the exposure light from an interface between the photoresist layer and the antireflective layer and a second reflection of the exposure light from an interface between the antireflective layer and the first layer, the first reflection having almost the same intensity as the second reflection to thereby substantially cancel the first and second reflections.

62. A substrate processing system comprising:

a substrate processing chamber;

a substrate support, located within the process chamber, for supporting a substrate;

a gas delivery system for delivering process gases into the substrate processing chamber;

means for flowing selected deposition gases into the substrate processing chamber at deposition gas flow rates;

means for adding a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from a reaction of the selected deposition gases, said desired low deposition rate being lower than a deposition rate using said selected deposition gases at said deposition gas flow rates with a lower flow rate of said inert gas; and